

BOVEY WATER TOWER
8th Avenue and T.H. 169
Bovey
Itasca County
Minnesota

HAER No. MN-59

HAER
MINN
31-BOV,
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Rocky Mountain Regional Office
Department of the Interior
P.O. Box 25287
Denver, Colorado 80225

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I. INTRODUCTION

Location: 8th Avenue and T.H. 169
City of Bovey
Itasca County
Minnesota

Date of Construction: 1907 (modified in 1937, demolished in 1992)

Owner: City of Bovey
Itasca County
Minnesota

Significance: The Bovey water tower was constructed in 1907 of cast iron material for the tower with a wooden-stave tank. Research into the engineering literature of the first decade of the 20th century indicates that flat-bottomed water tanks such as this one have largely been superseded by the now-common hemispherical-bottomed towers. The Bovey tower was one of the last of this type built and, perhaps, one of the last remaining in the State of Minnesota. The Bovey tower was considered eligible (for historical nomination by the Minnesota State Historical Preservation Office) on the basis of its date of construction (1907) as evidence of early municipal service activity in the City of Bovey.

Historian: Paul E. Vanderlinde, Registered Engineer, 1992

II. HISTORY

A. Construction

The Bovey water tower was constructed, according to the records of the Minnesota State Historical Preservation Officer, in 1906. City Council minutes show construction in 1907. The tower was constructed of what appeared to be cast iron. The original tank was constructed of wood. The water tower was constructed on the east end of the City of Bovey on what was the highest point in the developed part of the City. The earliest photographic evidence of the tower was in 1913 in a photo included in this document.

B. Modification

The original water tank was made of wood and was replaced by an all metal tank in 1937. The old wood tank was made like a barrel with metal bands to hold the tank together. A cutting torch was used to cut the metal bands and resulted in the wooden tank catching fire overnight. The fire was put out and the removal continued.¹

C. Study

Because of severe corrosion and pitting of the water tower structure, the City Council commissioned an engineering study in 1989. The study was conducted by Rieke Carroll Muller Associates, Inc., Grand Rapids, Minnesota, with a report published on July 26, 1989. Rieke Carroll Muller subcontracted to Twin City Testing, St. Paul, Minnesota, to inspect and make recommendations on the condition of the water tower.

Twin City Testing reported the following results of their review:

The tower of the tank appeared to consist of short sections of cast iron pipes serving as columns. The horizontal struts of the tower appeared to be composed of cast iron pipe using threaded couplings for splices. Diagonal rods were used for the tension members of the

tower. At all panel points, the fittings appeared to be cast iron members. All conclusions would have needed to be verified for metallurgical and chemical properties by taking samples before an extensive engineering review could have been made.

The cast iron fittings at each panel joint received the columns, the struts, and the diagonal rods providing a stressed transverse point. These joints would have needed some type of verification by radiography or ultrasonic examination to determine if they were slip joints, threaded connections or pin connections.

By visual review, the anchorage at the base of the columns could not be determined. Some of the cast fittings at the panel points were found to be broken. Some of the horizontal struts had corroded through the wall of the pipe at or near the connection to the fitting.

The opinions of Twin City Testing were that:

The tower had sustained severe corrosion. A thorough review of the structure would be of questionable value and expensive. Repair of various cast iron members by welding was not recommended and replacement parts would not be available.

The conclusions contained in the Twin City Testing report are:

The tower structure supporting the tank had sustained severe corrosion in some areas reducing the structural integrity. A visual and an undestructive evaluation of each joint in the tower structure would be required to evaluate the structure. A thorough evaluation of the structure would be expensive and of questionable value because of the joint configuration and the material used in the structure. The materials used in the geometry of the structural connections made it difficult and not practical to attempt making repairs.

The Twin City Testing report, then, contained the opinion that the tank should be replaced.

Rieke Carroll Muller Associates, Inc. incorporated the results of Twin City Testing into their report to the City. The RCM report contains the following "RCM studied the historical records of maintenance/repair on the tank/tower. The City has provided the proper amount of maintenance service. In 1984, prior to a major repainting inside, substantial amount of seam welding and pitting repair was done. The City retains the firm, Watertower Paint Repair, to provide an annual inspection on maintenance service.

"RCM performed an on-site visual inspection of the tower/tank. We found the water tank to be in fair condition. The painting of the interior is intact. The exterior of the tank does show some rust pitting and scaling on the tank bottom.

"The condition of the tower, however, raises a serious concern. Some of the columns and most of the horizontal struts show severe corrosion and pitting particularly at the joint fittings. In some areas the strut material has eroded completely through the tubing wall. The tower is apparently constructed of cast iron material. Although cast iron is a very durable material, it is nearly impossible to satisfactorily repair once it has corroded and weakened.

"RCM contracted with Twin City Testing Corporation, a noted material-testing firm, to advise on the tower/tank condition. The Twin City Testing report is included in the Appendix (A-1). Among their conclusions, Twin City Testing finds that:

- Severe corrosion exists in the tower structure.
- The materials and geometry make it impractical to attempt making repairs.
- The tank and tower should be replaced.

"As part of our investigation, we photographed the tower/tank and some of its details. The photographs are included as Appendix A-2 of this report.

"It is our opinion that, while the water tank could continue to provide service for some time, the tower structure has outlived its useful life. The city should be concerned about the safety of the tower. Also the health/safety concerns must be considered should the tower fail and City be forced to rely on the Coleraine backup for an extended period of time".

D. Replacement Water Tower

Following acceptance of the engineering report, the City Council determined a need to construct a new water tower. The City was able to receive grant funding from Minnesota Department of Trade and Economic Development and also from the Iron Range Resources and Rehabilitation Board. In 1991, the City constructed a new 125,000 gallon water tower at a cost of \$250,000.

III. Engineering Evolution of Water Towers

As water systems were being developed in the early 1890's, some form of elevated storage reservoir was needed. Otherwise, continuous pumping was required (except for compressed air systems for very small operations). On flat prairie land, standpipes and elevated tanks were used, but standpipes at that time were rather inefficient, so towers and tanks were becoming the accepted storage facility.² The elevated water tanks of the day usually involved the support of either a metal or a wooden stave tank on a heavy grillage of beams strong enough to transfer the considerable weight of the tank and its contents to the columns of the supporting tower.³ The first recorded Pittsburgh - DeMoines Corp. (PDM) project was the design, planning and layout of a water system for Boone, Iowa in early 1893. A part of the system was a small wooden flat-bottom tank supported on a wooden tower. The life of a

wooden tank was estimated at about 15 years, with repairs needed at approximately 8 years. Wood tanks made of pine, fir and cyprus could last from 20-25 years if heavy hoopage was employed.⁴ In 1894 a tank was built at Fort Dodge, Iowa and was the first built with a full hemispherical bottom. It was made of steel plates riveted together. The tower supporting the tank was also steel - the tank and tower were truly one single structure.⁵ By 1896, the patent for a steel tower was registered. This had been based on a steel tower and wooden tank at Union, Iowa in 1893. In 1897, the first PDM steel tower and steel tank (40,000 gallon capacity) was erected in Scranton, Iowa.⁶ A wooden design (on steel tower) in Alysian, MN, erected in 1896, was listed on the National Register Of Historic Places in 1981 and razed in 1989.⁷

By the start of the 20th Century, Chicago Bridge and Iron (CBI), had contracted for 85 elevated tanks in 23 states from New Jersey and Virginia in the east to Washington in the west, and Louisiana, Florida and Mississippi in the south. On June 25, 1907, George Horton, CBI, was issued was his first US patent carrying patent number 857,626. It was described as a hemispherical ellipsoidal bottom water tank supported on a riser. His next patent entitled "Ellipsoidal and cone bottom water tanks" was issued in November, 1911.⁸

Elevated tanks have often been used for advertising and display purposes. In 1915 the City Dairy Company of Toronto, Ontario, bought a 25,000 gallon reproduction of a milk bottle which was the first CBI tank used for advertising. Advertising tanks have been constructed in the shapes of a baby food jar, flour sack, tobacco can, pineapple, golf ball and a peach.⁹ By 1915, PDM had built water towers in 43 states, the District of Columbia, 8 provinces of Canada and several foreign countries. Sizes ranges from 2500 to 2 million gallon

capacity.¹⁰ CB&I engineers patented the radial cone bottom in 1929.¹¹ The stately spheroidal design, still popular today, followed soon after.

Early in the 1930's electric welding was beginning to be recognized. By the start of the 30's CBI had applied the new technology and was using welding instead of riveting first on tank roofs and then on roofs and bottoms.¹² In 1939 the transition from riveting to welding had been completed for CBI. The last large riveted contract was built in 1939. The first all welded water sphere tank was built that year in Longmont, Colorado.¹³ This is a single pedestal and it is very similar to designs still used today.

After World War II, in small town America, pent up war demand was joined by rising expectations for a standard of living that included indoor plumbing, guaranteed water quality and water-consumptive appliances. All these factors accelerated the shift from individual wells to municipal water systems.¹⁴ During the boom years of 1946 to 1980, two companies, the Chicago Bridge and Iron Company (CBI, Inc.) and the Pittsburgh-DeMoines Steel Co. (PDM, Inc.) dominated the business.¹⁵ CBI led PDM in the transition from riveting to welding, building an all welded tank with tubular columns on the campus of the University of Minnesota at Crookston in 1949. PDM erected a riveted tank with lattice columns at Alvarado in 1956. PDM's delay was partly due to opposition within its sales department, but by the late 1950's all-welded tanks had become the norm.¹⁶ The double ellipsoidal design dates from about 1950.¹⁷ These have cylindrical sides with ellipsoidal bottoms and tops. In 1954 the world's first water spheroid elevated tank was built for the City of Northbrook, Illinois.¹⁸ This is also single pedestal.

The torospherical design became pohe 1950's and remains common to the present (usually multi-legged structures).¹⁹

The single pedestal design was generally used from the 1960's to the present.²⁰ Also, the hydropillar design has been used from 1962 to the present.²¹ By the 1970's, tank sizes ranged from 10,000 to 3 million gallons.²²

IV. BOVEY WATER TOWER

The original Bovey water tower was 71 feet tall and had a capacity of approximately 75,000 gallons. The tower of the tank was composed of twelve individual columns placed in a crossed pattern. The columns were tubular members and appeared to be made of cast iron pipe. The horizontal struts were tubular members and appeared to be made of cast iron pipes. The diagonals were round steel rods with turn buckles. The fittings at the base of the columns were cast members and were probably cast iron. The column bases rested on quarried rock.

V. HISTORICAL SIGNIFICANCE

A. Local Significance

The role that the Bovey water tower played in the history of the community is documented in a review of the Minutes of the Proceedings of the Village Council. On January 20, 1905, the Council appointed a committee to look up purchasing sites for the Village Hall and water tank. On January 18, 1906 the Council asked for specifications and plans to erect a 75,000 gallon wooden tank, steel hoops on a steel substructure high enough to give a head sufficiently strong to throw a 3" stream over the top of a 3-story building and to install a pump of 500 gallon per minute capacity. The action also included specifications on connecting an 8" watermain on 2 blocks of the main street with taps at every 25'. On February 6, 1906, the Council appointed Holvar Oas as

superintendent of water works construction at a wage of \$4.00 per day. On April 17, 1906, the Council authorized advertising for bids for construction of a 40,000 gallon water tank. The Council later established the water rate at \$1.00 per month (payable in advance) for business places, \$2.00 per month for livery stables and \$.50 per month for dwelling units commencing June 1, 1906. A special election, held on August 10, 1906, authorized the Council to sell bonds in the amount of \$10,000 for a water system. Bonds were sold in September 1906. A contract for construction of the water tower was awarded to W.E. Caldwell, Louisville, KY in January 1907. The minutes do not indicate the bid or payment price of the tower.

On April 5, 1937, the Council heard a report on the condition of the water tank recommending that plans should be made to either make extensive repairs or replace the tank. At the same meeting, the Council moved to advertise for bids for a 75,000 gallon welded steel water tank. On May 5, 1937, the Council opened bids for erecting a new steel water tank and awarded contract, in the amount of \$5,383, to Pittsburgh-DesMoines Steel Co.

That tank served the water storage and supply needs of the City of Bovey until its razing in 1992.

B. State Significance

The record files of the Minnesota State Historical Preservation Officer (SHPO) contain the following entry:

"The Bovey tower was considered eligible on the basis of its date of construction (1906) as evidence of early municipal service activity in the City of Bovey. According to the file on Bovey in the SHPO History/Architecture Inventory, the western half of Bovey was platted in 1904. The eastern half, where the water tower is located, was platted in 1909. The casting on the base of the water tower contains the following:

Patent DEC 13, 1899 (may be 1897)

W.E. Caldwell

Louisville, KY

Research into the engineering literature of the first decade of the 20th century indicates that flat-bottomed water tanks such as this one have largely been superseded by the now-common hemispherical-bottomed towers. The literature cronicles early developments in hemispherical construction of steel around the turn of the century. The new construction type had largely replaced the older by the time this tower was constructed, thereby making this tower one of the last built, and perhaps one of the last remaining of this type in the state".

VI. PICTURE "GRACE"

The wording "Home of the Picture 'Grace'" was painted on the water tank. The following information, as published in a pamphlet and distributed by Enstrom Studios, Bovey, cites the history of the picture "Grace":

In the war year of 1918, a bearded, saintly old man with footscrapers to sell called on Eric Enstrom at his photography studio in the tiny mining town of Bovey, MN. The man's name was Charles Wilden.

Out of this chance encounter came a world-famous photographic study. Today Enstrom's picture, "Grace", showing the elderly peddler with head bowed in a mealtime prayer of thanksgiving, is known and loved throughout the world.

It happened, at the time, that Enstrom was preparing a portfolio of pictures to take with him to a convention of the Minnesota Photographers Association.

He wanted to take a picture that would show people that, even though they had to do without many things because of the war, they still had much to be thankful for.

On a small table Enstrom placed his large family Bible, and on it laid a pair of spectacles. Beside the Bible he placed a bowl of gruel, a loaf of bread, and a knife. Then he asked Wilden to place his folded hands to his brow in prayer before partaking of a meager meal.

When the negative was developed, Enstrom was sure he had something special . . . a picture that seemed to say, "This man doesn't have much of earthly goods, but he has more than most people because he has a thankful heart".

The picture caused little stir at the 1918 photography convention. A few years later, however, Enstrom took it to the convention again. This time it was hung in exhibit and received warm critical acclaim.

Most sales in the early 1920's were to traveling people who came through Bovey and saw the picture in the window of Enstrom's photo studio. As soon as one print was sold, he'd make another to take its place.

The early "Grace" pictures were printed in black and white or in brown tint. Later Enstrom's daughter, Mrs. Rhoda Nyberg, also of Bovey, began hand-painting them in oils and interest in the picture soared.

When demand for the picture outran Enstrom's ability to supply photographic prints, he sold the publishing rights to Augsburg Publishing House, Minneapolis, MN.

Printed in full, natural color, "Grace" is a cherished favorite in countless homes, churches and restaurants everywhere.

VII. COMMEMORATIVE MONUMENT

The City of Bovey is currently planning construction of a monument commemorating the old water tower. The monument, which will be constructed of actual parts of the old tower, will be located at the new water tower site. The next page of this document is a copy of the proof layout which the City intends to have inscribed in the commemorative monument.

VII. FOOTNOTES

1. Scenic Range News, 20 February 1992.
2. Versteeg, Jean D. The History of Pittsburgh-DesMoines Corporation, 1892-1981, p. 31
3. CBI Industries, Inc., The Bridge Works, p. 16
4. Versteeg, Jean D. The History of Pittsburgh-DesMoines Corporation, 1892-1981, p. 1
5. CBI Industries, Inc., The Bridge Works, p. 16
6. Versteeg, Jean D. The History of Pittsburgh-DesMoines Corporation, 1892-1981, p. 4
7. SPRENG, Ronald E. "They Didn't Just Grow There - Building Water Towers in the Postwar Era", Minnesota History, 53/4 Winter 1992, p. 136
8. CBI Industries, Inc., The Bridge Works, p. 23
9. Ibid, p. 38
10. Versteeg, Jean D. The History of Pittsburgh-DesMoines Corporation, 1892-1981, p. 31
11. CBI Industries, Inc., The Bridge Works, p. 71
12. Ibid, p. 77
13. Ibid, p. 95
14. SPRENG, Ronald E. "They Didn't Just Grow There - Building Water Towers in the Postwar Era", Minnesota History, 53/4 Winter 1992, p. 133
15. Ibid, p. 132
16. Ibid, p. 135
17. Ibid, p. 137
18. CBI Industries, Inc., The Bridge Works, p. 161
19. SPRENG, Ronald E. "They Didn't Just Grow There - Building Water Towers in the Postwar Era", Minnesota History, 53/4 Winter 1992, p. 136
20. Ibid, p. 136
21. Ibid, p. 137
22. Versteeg, Jean D. The History of Pittsburgh-DesMoines Corporation, 1892-1981, p. 32

IX. Bibliography

A. Books

Versteeg, Jean D., The History of Pittsburgh-DesMoines Corporation, 1892-1981, Pittsburgh, PA, Pittsburgh-DesMoines Corporation, 1982

CBI Industries, Inc., The Bridge Works, Chicago, IL, Mobium Press, 1987

Bovey, City of, City Council Proceedings, located in the Bovey City Hall.

B. Periodicals

Minnesota Historical Society, Minnesota History, St. Paul, MN, Winter 1992

C. Newspapers

Scenic Range News, Bovey, MN, 20 February 1992